

FLORISTIC DIVERSITY AND STRUCTURAL FEATURES OF SUBALPINE MEADOW VEGETATION (ON THE EXAMPLE OF THE TALYSH REGION)

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Abstract

The article studies the floristic composition, phytocenotic structure and ecological characteristics of the subalpine meadow vegetation of the Lerik and Yardimli regions, located in the high mountainous part of the Talysh mountain system. During the study, geobotanical descriptions were made of the Stipetum-Festucosum formations located at the foot of Mount Komurgoy in Lerik region and the Festuceta-Poaetum-Thymusosum formations distributed in the "Dere kecmez" summer pasture areas of Yardimli region.

As a result of the studies, it was determined that xerophyte and mesoxerophyte species predominate in both formations, which is associated with the harsh climatic conditions of the subalpine zone, intense solar radiation and relative humidity deficiency. Representatives of the Poaceae family were dominant in the studied phytocenoses. In particular, *Festuca ovina*, *Stipa transcaucasica*, *Stipa holocericea*, *Poa pratensis* and *Phleum pratense* species formed the main structure of the vegetation cover.

Among the shrubs and subshrubs, species belonging to the genus *Astracantha aurea*, *Acantholimon hohenackeri*, *Juniperus pygmaea* and *Thymus* are widespread. Perennial herbs predominated in terms of species diversity, while the presence of some mesophyte species was explained by the diversity of microrelief and soil-moisture conditions. During phenological observations, it was determined that most species were in the flowering phase, while legumes mainly entered the fruiting phase.

The total projected cover of the vegetation cover varied between 50–80%, and the stratification was mainly concentrated in the II and III tiers. The average height of the plants was recorded in the interval of 5–90 cm. The research results show that the subalpine meadows of Talysh, in addition to having high floristic richness, play an important ecological role in maintaining the stability of mountain ecosystems, preventing soil erosion and forming summer pasture resources.

The obtained materials can be used as a scientific basis for further research on the study of the geobotanical characteristics of the vegetation of the region, monitoring of subalpine grassland ecosystems and biodiversity conservation.

Keywords: subalpine grassland, geobotanical description, Talysh Mountains, floristic composition, xerophyte species, plant formation.

Introduction

Subalpine meadows are one of the richest and most dynamic vegetation types of mountain ecosystems, characterized by high biodiversity, complex phytocenotic structure and important ecological functions. These meadows are mainly located between the forest and alpine belts, creating a transition zone and are formed under the influence of various climatic, soil and relief factors. Subalpine vegetation is distinguished by both floristic richness and high productivity, playing an important role in protecting the ecological stability of mountain landscapes.

Subalpine meadows formed in the high mountainous areas of the Talysh mountain system have acquired unique floristic and phytocenotic characteristics as a result of the influence of specific natural and geographical conditions. The vertical zonation observed in the area, slopes with different exposures, heterogeneity of soil cover and humidity regime significantly affect the composition and structure of plant groups. As a result of the interaction of these factors, rich and complex phytocenoses with the participation of xerophyte, mesoxerophyte and mesophyte elements have formed here.

Subalpine meadows are also of great importance in terms of ecosystem services. This vegetation plays an important role in maintaining soil fertility, regulating surface flows, and preventing erosion and landslide

processes. At the same time, subalpine pastures are considered one of the main fodder bases for livestock in the summer season and are one of the economically important natural resources of the region. In addition, these areas are of particular scientific importance in terms of protecting biodiversity as a habitat for many rare, endemic, and relict plant species.

In recent years, the increase in anthropogenic impacts, especially overgrazing, climate change, and land cover degradation, have created certain changes in the natural structure of subalpine ecosystems. In this regard, the study of the modern state of subalpine vegetation, the assessment of its floristic composition, and phytocenotic structure are considered to be one of the urgent scientific problems.

The study of plant formations distributed in the subalpine belt of Talish is of great importance in terms of the systematic study of the flora and vegetation of the region, geobotanical zoning, and ecological monitoring. The study of the geobotanical characteristics of subalpine meadows located in the high mountainous areas of Lerik and Yardimli regions allows us to determine the structure, dominant species, ecological groups and biomorphological characteristics of these ecosystems. The results obtained create a scientific basis for future research on the protection, efficient use and biodiversity conservation of subalpine pasture ecosystems.

Research object and methodology

The studies were conducted in the subalpine belt of Lerik and Yardimli districts, located in the high mountainous part of the Talysh mountain system. One of the research areas was a subalpine meadow located at an altitude of 2493 m above sea level in the territory of Lerik district, at the foot of Mount Komürgey. The other research area covered the “Derə qəməzmez” summer pasture areas of Yardimli district. Both areas are characterized by a complex relief structure, high humidity variability and diverse soil and plant cover.

Geobotanical descriptions in the research areas were carried out according to classical geobotanical methods. The floristic composition of plant groups was studied, the abundance of species, project cover, storey, life forms, ecological groups and phenological state were determined. During geobotanical descriptions, the degree of participation of each species in the phytocenosis and its dominance characteristics were taken into account.

The abundance of species was assessed with scores according to the Drude and Brown-Blanquet systems, and the storey of plants was analyzed in order to determine the vertical structure of the phytocenosis. The average height of plants was measured in centimeters and their location in different layers was determined. The percentage indicators of the project cover were used to assess the density and bioproductivity of the phytocenosis.

During the floristic analysis, the ecological groups of species were determined based on their relationship to humidity and temperature. For this purpose, the plants were mainly divided into xerophyte, mesoxerophyte and mesophyte groups. The results of the study showed that xerophyte and mesoxerophyte elements

predominate in the subalpine zone, which is related to the climatic characteristics of the area.

The life forms of plants were grouped according to their biomorphological characteristics into shrubs, subshrubs, perennials, biennials and annual herbs. This division allowed us to determine the structural characteristics of phytocenoses and the distribution of dominant biomorphs. During phenological observations, the vegetation, flowering and fruiting stages of species were recorded.

Regional flora sources and systematic determinants were used to determine the species. As a result of a comparative analysis of the research materials, the floristic diversity, dominant species, and ecological characteristics of subalpine meadow formations were determined.

Results and discussion

Stipetum-Festucosum formation

The Stipetum-Festucosum formation recorded in the Lerik region developed mainly on grassy mountain-meadow soils. The formation is dominated by xerophytic species. Cereals such as *Festuca ovina*, *Stipa transcaucasica*, *Poa pratensis* and *Phleum pratense* occupy an important place in the floristic composition.

Among the shrubs, *Astracantha aurea*, *Acantholimon hohenackeri* and *Juniperus pygmaea* species are widespread. Among the semi-shrubs, *Thymus kotschyanus* is considered one of the dominant species. The species diversity of perennial grasses was higher, and mesoxerophytic and mesophytic elements were also found here.

Phenological observations showed that most species were in the flowering phase, and some legumes were in the legume stage. The total plant cover in the formation was 50–80% (Geobotanical description 1)

Species composition and structure of the Stipetum-Festucosum formation; Lerik district territory, subalpine zone. At the foot of Mount Kömürgey (2493 m above sea level) on grassy mountain-meadow soil

№	Biomorphological types	Ecological groups	Abundance (in points)	Total Design Cover (%)	Above-ground stratification and height (cm)
1	2	3	4	5	6
<u>Kollar</u>					
1.	<i>Astracantha aurea</i> (Willd.) Podlich.	Xerophyte	1-2	II (25-40)	Flwr
2.	<i>Acantholimon hohenackeri</i> Jaub. et Spach. Boiss.	Xerophyte	1-2	III (20-30)	Flwr
3.	<i>Astracantha gutrathi</i> (Al.Teod., Fed. et Rzazade) Podlech.	Xerophyte	1	III (10-25)	Flwr
4.	<i>Juniperus pygmaea</i> C.Koch.	Xerophyte	1	III (10-20)	Vgtn
5.	<i>Onobrychis cornuta</i> (L.) Desv.	Xerophyte	1	III (5-15)	Frt
<u>Yarımkolcu</u>					
6.	<i>Thymus kotschyanus</i> Boiss. et Hohen.	Xerophyte	1-2	III (15-30)	Flwr
7.	<i>Stachys inflata</i> Benth.	Xerophyte	1	II (30-40)	Flwr
<u>Çoxillik otlar</u>					
8.	<i>Festuca ovina</i> L.	Xerophyte	3-4	III (10-30)	Flwr
9.	<i>Stipa transcaucasica</i> Grossh.	Xerophyte	2-3	II (40-60)	Flwr
10.	<i>Poa pratensis</i> L.	mesoxerophyte	1-2	III (20-30)	Flwr
11.	<i>Phleum pratense</i> L.	mesophyte	1-2	II (50-70)	Flwr
12.	<i>Achillea millefolium</i> L.	mesoxerophyte	1-2	II (40-60)	Flwr
13.	<i>Helictotrichon pratensis</i> L.	Xerophyte	1-2	II (30-50)	Flwr
14.	<i>Vicia truncatula</i> Fisch.	mesoxerophyte	1-2	II (30-40)	Frt
15.	<i>Alchimilla oxysepala</i> Juz.	mesoxerophyte	1	II (50-80)	Flwr
16.	<i>Stachus macrantha</i> (C.Koch.) Stearn.	mesoxerophyte	1	II (40-70)	Flwr
17.	<i>Anisantha riparia</i> (Rehm.) Holub.	Xerophyte	1	II (30-50)	Flwr
18.	<i>Teucrium orientale</i> L.	Xerophyte	1	III (25-30)	Flwr
19.	<i>Deschampsia caespitosa</i> (L.)	mesophyte	1	III (20-25)	Flwr
20.	<i>Festuca pratensis</i> Huds.	mesophyte	1	III (15-20)	Flwr
21.	<i>Poa meyeri</i> Trin. ex Roshev.	mesophyte	1	III (10-20)	Flwr
22.	<i>Trisetum rigidum</i> (Bieb.) Roem. et Schult.	Xerophyte	1	III (10-15)	Flwr
23.	<i>Plantago saxitalis</i> Bieb.	mesoxerophyte	1	III (5-10)	Flwr
24.	<i>Ranunculus caucasicus</i> Bieb.	mesophyte	1	III (4-8)	Flwr
<u>İkillik otlar</u>					
25.	<i>Verbascum songaricum</i> Schrenk.	mesophyte	1-2	II (30-50)	Flwr
26.	<i>Carum carvi</i> L.	mesophyte	1	II (30-50)	Flwr
<u>Birillik otlar</u>					
27.	<i>Bromus brizaformis</i> Fisch. et C.A.Mey.	Xerophyte	1-2		Flwr
28.	<i>Rumex reticulatus</i> Boiss.	mesophyte	1		Vgtn
29.	<i>Euphorbia hyrcana</i> A.Grossh.	Xerophyte	1		Flwr.
The total project coverage is 50-80%.					

Festuceta-Poetum-Thymusosum formation

In this formation, which is widespread in the “Dere geçmez” summer pasture areas of the Yardımlı region, the main dominant species were *Festuca ovina*, *Stipa holocericea* and *Thymus trautvetteri*. Although xerophytic elements predominated in the vegetation cover, the presence of mesophytic species was also observed.

Perennial grasses make up the main part of the floristic composition. Species such as *Filipendula ulmaria*,

Dactylis glomerata, *Koeleria cristata* and *Trifolium repens* were recorded here. *Anisantha tectorum* and *Lotus angustissimus* are more widespread among annual grasses.

The plant layering was mainly concentrated in the II and III layers, the average height varied between 5–90 cm. The design cover was 50–80%, which indicates that subalpine meadows have a fairly dense vegetation cover. [Geobotanical description 2]

Species composition and structure of the Festuceta-Poaetum-Thymusosum formation; Yardimli district territory, "Der geçmez" summer pasture areas

№	Biomorphological types	Ecological groups	Abundance (in points)	Total Design Cover (%)	Above-ground stratification and height (cm)
1	2	3	4	5	6
Shrubs					
1.	<i>Acantholimon hohenackeri</i> Jaub. et Spach. Boiss.	Xerophyte	1-2	III (20-30)	Flwr
2.	<i>Astracantha aurea</i> (Willd.) Podlich.	Xerophyte	1	II (15-30)	Flwr
3.	<i>Astragalus euoplus</i> Trautv.	Xerophyte	1-2	III (20-30)	Frt
Subshrubs					
4.	<i>Thymus trautvetteri</i> Klok. et Shost.	Xerophyte	3-4	III (10-20)	Flwr
5.	<i>Achillea vermicularia</i> Trin.	Xerophyte	1-2	II (30-50)	Flwr
Perennial herbs					
6.	<i>Poa meyeri</i> Trin. ex Roshen.	mesophyte	1	II (30-40)	Flwr
7.	<i>Festuca ovina</i> L.	Xerophyte	3-4	III (10-20)	Flwr
8.	<i>Stipa holocericea</i> Trin. et Rupr.	Xerophyte	2-3	II (30-60)	Flwr
9.	<i>Onobrychis altissima</i> Grossh.	mesophyte	1-2	II (30-50)	Frt
10.	<i>Filipendula ulmaria</i> (L.) Maxum.	mesophyte	1	III (70-90)	Flwr
11.	<i>Elytrygia trichophora</i> (Link.) Gould. Shinnere.	Xerophyte	1	II (40-60)	Flwr
12.	<i>Bromopsis variegata</i> (Bib.)	Xerophyte	1	III (30-50)	Flwr
13.	<i>Koeleria cristata</i> (L.) Pers.	Xerophyte	1	II (30-40)	Flwr
14.	<i>Alchimilla sericata</i> Reichenb. ex Bus.	Xerophyte	1	III (25-30)	Flwr
15.	<i>Dactylus glomerata</i> L.	Mesoxerophyte	1	III (20-25)	Flwr
16.	<i>Alopecurus glacialis</i> C.Koch.	Mesoxerophyte	1	III (15-20)	Flwr
17.	<i>Trifolium repens</i> (L.) Presl.	Xerophyte	1	III (10-15)	Frt
18.	<i>Colpodium versicolor</i> (Stev.)	Xerophyte	1	III (5-10)	Flwr
19.	<i>Taraxacum montanum</i> (C.A.Mey.) DC.	Xerophyte	1	III (4-8)	Flwr
20.	<i>Hieracium multisetum</i> Nalg. et Peter.	mesophyte	1	III (3-7)	Flwr
21.	<i>Potentilla bifursa</i> L.	Xerophyte	1	III (2-6)	Flwr
22.	<i>Dianthus talyschensis</i> Boiss.	Xerophyte	1	III (2-4)	Vgtn
Annual herbs					
23.	<i>Anisantha tectorum</i> (L.) Nevski.	Xerophyte	1-2	III (20-30)	Flwr
24.	<i>Lotus angustissimus</i> L.	mesophyte	1-2	III (10-20)	Flwr
25.	<i>Vicia hyrcanica</i> Fisch. et C.A.Mey.	Xerophyte	1	III (5-15)	Frt
The total project coverage is 50-80%.					

Conclusion

The conducted studies show that the subalpine meadow formations widespread in the high mountainous areas of Talysh have a rich floristic composition and a complex phytocenotic structure. The predominance of xerophyte and mesoxerophyte species in the studied formations is an indicator of adaptation to the climatic and soil conditions of the area. The fact that

most of the dominant species belong to the cereal family indicates that this group plays an important role in the formation of subalpine pasture ecosystems.

These plant groups are of great importance in terms of protecting biodiversity, maintaining summer pasture resources and ensuring the stability of mountain ecosystems.

References

1. Aslanova, S (2025). Ecology. ASPU. Baku. P-347.
2. Aslanova, S. (2019). Flora and vegetation of the mountainous part of Lankaran. Printing house ADMIU.
3. Didukh, Y., Pashkevych, N., Kucher, O., & Chusova, O. (2023). Impact of climate change on ruderal communities in the conditions of Ukraine. *Ekológia*, 42(1), 39-46.
4. Jiang, L., Bao, A., Guo, H., & Ndayisaba, F. (2017). Vegetation dynamics and responses to climate change and human activities in Central Asia. *Science of the Total Environment*, 599, 967-980.
5. Aslanova, S. (2023). New Locations of Some Plant Species in the Mountain Part of Yardimli, Lerik and Astara Districts (Azerbaijan). *Bulletin of Science and Practice*, 9(1), 55-59.
6. Aslanova, S. (2024). Subalpine Meadow Vegetation of Talish Highlands of Azerbaijan. *Бюллетень науки и практики*, 10(2), 38-46.
7. Aslanova, S., & Asadova, B. (2023). Flora and fauna of Azerbaijan. ASPU. Baku. P-347.
8. Braun-Blanquet J. Plant Sociology: The Study of Plant Communities. New York, 1965.
9. Chursin, A. I., Nartova, E. A., Krukova, N. A., & Melentyev, A. A. (2022, February). Forest management assessment of as forest use rational type. In *IOP Conference Series: Earth and Environmental Science* (Vol. 981, No. 4, p. 042091). IOP Publishing.
10. Elshad, K., Aslanova, S., & Aslanova, F. (2024). *BIOLOGICAL SCIENCES. BIOLOGICAL SCIENCES*, 58, 3.
11. Galiullin, I. R., Glushko, S. G., Prokhorenko, N. B., Hamitova, S. M., & Pestovskij, A. S. (2021, October). Features of forest dynamics in developed regions. In *IOP Conference Series: Earth and Environmental Science* (Vol. 876, No. 1, p. 012029). IOP Publishing.
12. Gurbanov, E. M., Sh, A. S., & Asadova, B. Q. (2023). PHYTOECOLOGICAL RESEARCH ON OIL-CONTAMINATED SOILS OF "SHIRVANNEFT" OIL AND GAS DEVELOPMENT AREA AND ITS RECULTIVATION (AZERBAIJAN). *Труды Мордовского государственного природного заповедника им. П.Г. Смирнова*, (33), 172-183.
13. Gurbanov, E., & Aslanova, S. (2023). Phytocenoses found in grassy mountain-meadow soils in the subalpine zone of Talish. In *Proceeding Book of 3rd International Conference on Scientific and Academic Research ICSAR* (Vol. 1, No. 2, pp. 81-84).
14. Gurbanov, E., & Aslanova, S. (2024). Average annual productivity of the *Thymus seta-vicaetum-festucosum* formation, distributed in summer pasture field No. 8 "Turkesoba" (AZERBAIJAN). *Norwegian Journal of Development of the International Science*, 126.
15. Gurbanov, E., & Aslanova, S. (2024). COMPARATIVE ANALYSIS OF THE FLORA OF THE ABSHERON PENINSULA AND THE OIL-CONTAMINATED FLORA OF AZERBAIJAN. *Deutsche internationale Zeitschrift für zeitgenössische Wissenschaft* ... № 92 2024 VOL., 16.
16. Gurbanov, E., & Aslanova, S. (2025). Study of the Area, Environmental Conditions of the "Bina-gadineft" NGCI Mines in the Absheron Peninsula of the Republic of Azerbaijan, and Study of Vegetation-Soil Cover Contaminated by Oil and Oil Products. *Advanced Studies in Biology*, 17(1), 11-17.
17. Gurbanov, E., & Aslanova, S. (2025). VEGETATION OF ALPINE MEADOWS AND ALPINE CARPETS OF THE TERRITORY OF THE REPUBLIC OF AZERBAIJAN. *German International Journal of Modern Science/Deutsche Internationale Zeitschrift für Zeitgenössische Wissenschaft*, 11(3).
18. Gurbanov, E., Aslanova, S., & Huseynova, A. (2024). The impact of climate change on phytocenoses in the mountainous part of Talysh. *JOURNAL OF LIFE SCIENCES*, (2), 46.
19. Heydarova, A., & Aliyev, P. (2025). The Role of Physical-Geographic Factors in the Formation of the Forests of Lankaran Natural Region. *Nature & Science/Təbiət və Elm*, 7(4).
20. Imanberdieva, N. (2015). Flora and plant formations distributed in At-Bashy Valleys–Internal Tien Shan in Kyrgyzstan and interactions with climate. In *Climate Change Impacts on High-Altitude Ecosystems* (pp. 569-590). Cham: Springer International Publishing.
21. Kurbanov, E., & Aslanova, S. (2024). National-Economic Significance of the Vegetation Cover of Atropatene (within the Republic of Azerbaijan).
22. Petrova, E., & Sultangazina, G. (2015). The current state of the tree-shrub flora in the National Park Burabai. *UDK*, 528(99), 574-23.
23. Prilipko L.İ. *Rastitelnost Azerbaydjana*. Bakı, 1970.
24. Qrossheym A.A. *Flora Kavkaza*. Moskva–Leningrad, 1949–1967.
25. Qurbanov, E. M., & Cabbarov, M. T. (2017). *Geobotany*. Baku: Baku State University publishing house.
26. Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology*.
27. Qurbanov, E., Aslanova, S., & İbrahimov, Ş. (2024). ŞİRVAN RAYONUNUN NEFTLƏ ÇİRKƏNMIŞ TORPAQLARINDA RAST GƏLİNƏN YARIMSƏHRA BİTKİLİYİNİN FİTOEKOLOJİ XARAKTERİSTİKASI. *Nature & Science/Təbiət və Elm*, 6(1).
28. Yakhyayev, A., & Melikov, A. (2025). Spread of Forest Ecosystems in Azerbaijan, Structure, Usage Changes and Learning. *Journal of Forest and Ecosystem Sciences* Vol, 1(1).
29. Гурбанов, Э. М., & Асланова, С. Ш. (2013). Новые местонахождения некоторых видов растений в горной части Ленкорани. *Географическая среда и живые системы*, (2), 21-24.
30. Гурбанов, Э., Асланов, С., & Сафарова, А. (2024). КЛИМАТИЧЕСКИЕ УСЛОВИЯ ГОРНОЙ ЧАСТИ ТАЛЫША. *German International Journal of Modern Science/Deutsche Internationale Zeitschrift für Zeitgenössische Wissenschaft*, (90).
31. Эльшад, К., & Асланова, С. (2024). ИСТОРИЯ И ЗНАЧЕНИЕ ИЗУЧЕНИЯ ФИТОМЕЛИОРАЦИИ НЕФТЕЗАГРЯЗНЕННЫХ ЗЕМЕЛЬ В АЗЕР-

БАЙДЖАНЕ. German International Journal of Modern Science/Deutsche Internationale Zeitschrift für Zeitgenössische Wissenschaft, (80).

32. Larkum, A. W., Orth, R. J., & Duarte, C. M. (2006). Seagrasses: biology, ecology and conservation. *Phycologia*, 45(5), 5.

33. Эльшад, К., & Санубар, А. (2024). ЭКОЛОГИЧЕСКАЯ КЛАССИФИКАЦИЯ ПОЧВЕННО-

РАСТИТЕЛЬНЫХ ТЕРРИТОРИЙ, ЗАГРЯЗНЕННЫХ МИНЕРАЛИЗОВАННЫМИ ВОДАМИ НА АПШЕРОНСКОМ ПОЛУОСТРОВЕ. German International Journal of Modern Science/Deutsche Internationale Zeitschrift für Zeitgenössische Wissenschaft, (75).